ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 84.] DECEMBER. [1893.

CCCXLV.—ROOT DISEASE OF SUGAR-CANE.

The July number of the *Kew Bulletin* contained an account of a disease which has within the last few years made its appearance amongst the sugar-canes in the West Indies. It proves to be due to a fungus, hitherto undescribed, to which the name of *Trichosphæria* has been given. It attacks the parts of the plant above ground. As it has been found at Kew to readily develop on the young leaves of the bamboo, it is not improbable that it will also attack other *Gramineæ*. Its original host was therefore probably some indigenous or introduced grass, from which it has transferred itself to the sugar-cane.

More recently another disease has been the subject of investigation at Kew, which, unlike the *Trichosphæria*, does its chief mischief by attacking the "roots" of the young plant, and thus arresting, in consequence, the development of the canes. The following correspondence gives the history of the matter. As it appears to be identical with a disease originally described in Java, it is not impossible that it has been introduced from the East Indies.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, October 21, 1893.

I AM directed by the Marquis of Ripon to transmit to you the accompanying copy of a Despatch from the Governor of Barbados, with its enclosure, and to request that you will be good enough to report on the specimens of canes attacked with a root disease which the Superintendent of the Botanical Station in Barbados has forwarded to you.

I am, &c.

The Director, (Signed) JOHN BRAMSTON.
Royal Gardens, Kew.

GOVERNOR OF BARBADOS to COLONIAL OFFICE.

Government House, Barbados,

MY LORD MARQUIS, October 3, 1893.

I HAVE the honour to enclose an extract from a minute from the Superintendent of the Botanical Station on the subject of a cane disease, specimens of which he is sending to Kew for examination.

U 79561.—1. 1375.—1/94. Wt. 134. A

2. I shall be glad if your Lordship will be so good as to ask the authorities at Kew kindly to make the desired report on the specimens sent by Mr. Bovell.

I have, &c.
(Signed) J. S. Hay.

The Most Hon.
the Marquis of Ripon, K.G.,
&c. &c. &c.

[Enclosure.]

Superintendent, Botanical Station, to Colonial Secretary.

Hon. Col. Secretary,

* * * *

I have the honour to respectfully ask permission to be allowed to send next mail to Kew specimens of the canes which are being attacked in St. John's parish with a root disease, and at the same time to say that his Excellency is writing to the Secretary of State for the Colonies requesting him to ask the authorities at Kew to be so good as to have them reported on.

2. In the early part of 1891 I forwarded to Kew specimens of this root disease, and Mr. Massee was asked to report on them; this he did, but owing to the absence of fruit on the specimens he was only able to hazard the opinion that the fungus belonged to the genus *Botrytis*. Now I hope by sending a couple of stools of canes with the soil adhering to the roots the matter may be definitely settled.

(Signed) John R. Bovell.

September 28, 1893.

Extract from Letter from Curator, Botanical Station, Grenada, to Royal Gardens, Kew, dated August 4, 1893

I have just returned from Barbados. While there I had a careful investigation of the fungus attacking the sugar-cane, in company with Mr. Bovell. It has caused terrible havoc on some of the estates in St. John's parish. Many of them will take five or six acres to make a hogshead. What struck me at the first glance was that in all the diseased fields it was only the Bourbon cane affected. The Caledonian Queen and Transparent are healthy and vigorous. It does not seem to me to require much study as to the best course to pursue, but Mr. Bovell tells me that so conservative are the planters that they will persist in attempting to grow the weaker Bourbon on a soil evidently unsuited for it.

Royal Gardens, Kew, to Colonial Office.

Royal Gardens, Kew,
November 3, 1893.

Sir,

I have the honour to acknowledge the receipt of your letter of October 21, transmitting a copy of a Despatch from the Governor of Barbados on the subject of a root disease of sugar-canes.

2. The specimens sent by the Superintendent of the Botanical Station have been carefully examined, and I enclose a technical report upon them.

3. The disease is totally distinct from that which was the subject of my letter of April 5 last. It is practically identical with one which exists in Java, from which it is not improbable that it has been introduced.

4. It is evident that the weak point in sugar-cane cultivation in the West Indies is the want of care in the propagation of the canes. The very finest and most healthy canes should be scrupulously selected and set apart for the purpose. Unfortunately, any weakly or even diseased canes appear to be thought good enough. Apparently, in consequence of this short-sighted practice, a disease, which under ordinary circumstances would have been of little moment, has assumed troublesome dimensions.

5. It appears to me that the cultivation of the sugar-cane generally in Barbados is not prosecuted with much intelligence. The outbreak of disease in a cultural staple is not always to be looked upon as simply "the act of God," but is often aggravated, if not actually produced, by the neglect of reasonable precautions.

I long ago pointed out, and it is now beginning to be understood, that an immense deal can be done for the improvement of the sugar-cane by the continuous selection for propagation of the best possible canes. Not merely should this be done systematically on individual estates, but it should be carried on at the Botanical Station. In the latter case, the canes should be systematically analysed in order to select those canes which are richest in sugar.

6. In this connexion, I am sorry to learn from Mr. Bovell, in a letter which accompanied the specimens of diseased canes, that nothing has been done with regard to the provision of a larger experimental station. A committee appears to have been appointed by the Legislative Council to consider the matter and was allowed to lapse without reporting.

7. In conclusion, I must point out that, though Kew may be able to be of some assistance in technical matters like the present, it cannot supply the cultivator with the energy and intelligent resource, without which no industry in the long run can be successfully prosecuted.

I am, &c.

(Signed) W. T. Thiselton-Dyer.

John Bramston, Esq., D.C.L., C.B.,
Colonial Office, Downing Street, S.W.

Report on "Root Disease" of Sugar-Cane from Barbados.

The stools of sugar-cane sent to Kew by Mr. Bovell from Barbados, for the purpose of ascertaining the cause of the "root disease," arrived in excellent condition for that purpose, and an examination of them demonstrates conclusively that the disease is due to a parasite fungus known as *Colletotrichum falcatum*, Went. The fungus cannot effect an entrance through the unbroken surface of the stem of the sugar-cane. But the conidia germinate on decaying lateral shoots, or the ragged base left by fallen leaves. Its entrance into the living portion is indicated by a bright red coloration of the fibro-vascular bundles, the colour subsequently extending to the ground tissue.

When an entrance has been effected the hyphæ spread rapidly throughout the length of the cane, and after a time the fructification ruptures the epidermis in the neighbourhood of the joints, and appears on the surface as a more or less effused, black, minutely velvety patch.

Microscopic examination shows the velvety appearance of the fruiting patches to be due to the presence of numerous rigid, dark-coloured hairs, springing from a dense basal weft of colourless hyphæ; these latter also bear large numbers of minute, colourless conidia, or reproductive bodies. The conidia are capable of germinating the moment they are mature,

and, being produced quickly and readily disseminated, easily infect neighbouring plants.

A second kind of conidia are formed on the oldest portions of mycelium present in the tissues, two or three large globose conidia being frequently found on the hyphæ present in a single cell of the cane. These internal conidia can only escape when the cane in which they exist has become thoroughly decayed. The fungus, under normal conditions, attacks the above-ground portions of the cane, the "root disease" condition being a modification of the normal form, called into existence by the method of cane cultivation adopted.

A careful examination of all the canes forwarded shows that the portion buried in the ground contains much more mycelium than that above ground; the mycelium in the root is also more mature, frequently producing enormous quantities of conidia in the cells. In some instances the root was rotten and decayed, the disintegration being effected by the fungus; nevertheless there is not the slightest evidence to favour the idea that the disease originated *after* planting. Many of the small roots contained a large quantity of mycelium, but it was evident in every case that this had passed from the stock into the root. On the other hand, everything points to the conclusion that the portions of cane used for propagation already contain the mycelium of the fungus, although its presence may not be indicated externally, and that the mycelium present in the buried portion of the cane, favoured by darkness and moisture, develops at an abnormal rate, thus assuming the character of a disease, which in its intensity is foreign to the fungus when developing under normal conditions. Two additional species of fungi, not in any way connected with the disease, were common on fading leaves of the canes; the one, a species of *Chætostroma*, the other a *Botrytis*. The last mentioned was also found on canes sent previously by Mr. Bovell, and it was suggested at the time that it might be connected with the disease. But further investigation has not in any way confirmed this; the *Botrytis* may for the future be dismissed from consideration.

The sugar-cane disease in Java, called *Rood Snot*,* is apparently the same thing, and it would be interesting to ascertain if this is the source from which it has been introduced into the West Indies.

Summary.

The disease is caused by a parasitic fungus called *Colletotrichum falcatum*, Went., and the evidence points to the injudicious use of diseased canes for propagation as the cause of the injury to the crop which is now experienced.

Preventive Measures.

1. All diseased canes should be burnt and not allowed to decay naturally.

2. Perfectly healthy canes should be used for propagation, and to secure this, the canes should be obtained from an area not infected with the disease.

3. Mr. Bovell, in a letter addressed to Kew, says:—"I have managed "to stamp out the disease here by growing other crops on the fields "attacked, for a year or two." This is a very essential point, as the litter of cane leaves, &c. on the ground will be infected with the fungus,

* Het *Rood Snot:* Dr. Went (H. van Ingen : Soerabaia, 1893).

and perfectly healthy plants would be attacked if planted at once on an infected site.

4. There is reason to think that if perfectly healthy and uninfected canes were only used for propagation, the disease would not be found to give much trouble.

G. M.

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, December 19, 1893.

I AM directed by the Secretary of State for the Colonies to transmit to you a copy of a Despatch from the Officer Administering the Government of Barbados, conveying the thanks of his Government for your report on sugar-cane disease.

I am, &c.

The Director, (Signed) R. H. MEADE.
Royal Gardens, Kew.

The OFFICER ADMINISTERING THE GOVERNMENT OF BARBADOS to COLONIAL OFFICE.

Government House,

MY LORD MARQUESS, November 30, 1893.

I HAVE the honour to acknowledge the receipt of your Lordship's Despatch, No. 118, of the 7th instant, forwarding a copy of a letter and report from Mr. W. T. Thiselton-Dyer on the subject of cane disease now prevalent in Barbados.

2. On behalf of the Government of Barbados, I beg your Lordship to convey my sincere thanks to Mr. Thiselton-Dyer for all the trouble he has taken, and for his valuable report, which will be of great use to the planters.

I have, &c.

The Most Hon. (Signed) GEORGE PATON, Major-General,
the Marquess of Ripon, K.G., Acting Governor.
&c. &c. &c.

EXTRACT from LETTER from C. A. BARBER, Esq., F.L.S., Superintendent, Agricultural Department of the Leeward Islands, to ROYAL GARDENS, KEW, dated Coverley Estate, Barbados, December 1, 1893.

I have carefully examined canes attacked by a disease which is known locally as "root fungus." The general effect of this disease is that canes planted in December appear to receive a check in their growth about June or July following. As the time proceeds the plant gradually dwindles, although many attempts are made by fresh basal shoots to supply the place of dying ones. After the lapse of six months, *i.e.*, in November or December, on the eve of crop time, no *cane* has been formed, growth having apparently been completely arrested.

This disease attacks Bourbon canes much more frequently than the other varieties, such as Caledonian Queen, Striped Singapore, and Purple Transparent, which are met with in the same fields. The Caledonian Queens are not very good, but they are arrowing freely, and the difference between them and the Bourbons in the same field is marked enough.

I have been over the country where the attack is severest, and have collected typical specimens and placed them in alcohol on the spot. (The loss in one estate is perhaps 75 per cent.)

The strictures passed on the cultural methods pursued in Barbados in the correspondence with the Colonial Office having been held to be too severe, the following extract from a local paper is published. The testimony of an eye-witness on the spot conclusively proves that the faultiness of the methods pursued has been by no means over-rated.

EXTRACT from *Barbados Bulletin*, December 12, 1893.

REFUSING TO BE WARNED.

After the repeated warnings which our planters have received from the Kew authorities respecting the prevalent cane diseases and the necessity of being careful in the selection of seed, or cane-plants, many of our planters are still pursuing the old and irrational methods of selection that have been condemned by those who speak authoritatively on the subject. While passing through several estates last week, we witnessed the process of collecting and selecting cane sprouts for planting, and on carefully examining their quality, in order to ascertain if sufficient attention had been given in their selection, we found on one estate (managed by one of the oldest, most experienced, wealthiest, and respected planters in this island) that a large quantity of plants had been purchased from labourers on the estate who had grown small, stunted, sickly-looking canes on the poor patches of soil around their huts, and it is from these stunted canes the sprouts had been taken. On another estate we saw plants selected for sowing that had the rind fungus on many of them, which the unscientific overseer assured us would be destroyed in the process of soaking in lime-water before planting; and on a third estate, one of the largest in the island, we saw a great heap of plants, many of which on examination were found to be attacked with the borer. Here, then, were men boasting of their experience as planters, who were engaged in propagating disease by sowing the very evils against which they profess to be contending. A more suicidal policy could not be imagined. And on asking one of these agricultural wise-acres why such poor seed had been selected, and why a nursery of strong, healthy canes had not been established on the estate for the purpose of supplying it with good, vigorous seed plants, he replied that they could not afford to divert sufficient land for the purpose, and that it was cheaper to buy sprouts from the labourers than to grow them as we had suggested. Some, indeed many, of our planters are annoyed because Mr. Thiselton-Dyer has laid the blame of the prevalent cane-pests at their door; but if his statement needed any vindication, that the planters are themselves largely responsible for the evils that exist through their neglect of necessary precautions and their carelessness in selecting cane plants, that vindication the planters are themselves supplying by following the condemned customs of the past and recklessly pursuing a course that can only tend to the perpetuation and increase of the evils they profess to be anxious to avert.

CCCXLVI.—PERUVIAN COLONISATION.

The Peruvian Corporation, Limited, has undertaken an interesting experiment in planting enterprise.

It has obtained possession, for the purpose, of a tract of country in Central Peru, east of the Andes. It extends for a distance of about 40 miles along the course of the Perené river, a tributary of the Amazons,

from the River Eneno (1,700 feet), to the Cascades (1,050 feet), and to a distance of 30 miles on either side of the Perené.

The land was reported on to the Corporation by Mr. P. D. G. Clark, a member of the Gardening staff of the Royal Botanic Gardens, Ceylon, in 1891.

West of the area is the Chanchamayo Valley, traversed by the River Chanchamayo, which runs into the Perené. An account of its products will be found in the "Reports from the Consuls of the United States" for June 1893.

The railway from Callao and Lima has been now completed to Oroya, 136 miles from Callao.

Mr. Daugherty, the United States Consul, reports: "From Oroya to "the head of the valley of Chanchamayo, one of the most fertile dis- "tricts of Peru, is a distance of about 40 miles, and the products of this "valley that find their way to the coast now come on the backs of "mules, donkeys, and llamas to Oroya, over rough mountain roads, "which, for most of the distance, are mere paths."

The enterprise is still in its infancy. The following papers are published for general information. They have the merit of avoiding too roseate a picture, of recognising difficulties, and of fairly indicating the conditions which will alone command success.

The Peruvian Corporation, Limited, to Royal Gardens, Kew.

66, Old Broad Street, London, E.C.,
4th October 1893.

Dear Mr. Thiselton-Dyer,

I think you know that we are doing a little planting in the Andes in Peru near the Perené river. Our man there says he has got 80,000 seedlings of coffee, obtained no doubt from his own district. He expresses a desire now to have a quantity, say five bushels, of Blue mountain seed. Can you kindly tell me the best person to write to in Jamaica. The idea of having two classes of coffee growing is, I believe, that by this means he hopes to avoid the diseases which did so much harm in Ceylon and elsewhere, from propagating too closely from one jàt.

I enclose you copy of a letter from Mr. Robb, dated 27th July last, giving a general report for the year ending 30th June, which may interest you, and perhaps you may think fit to incorporate some of it in your *Kew Bulletin*. Mr. Mackenzie is in charge of the Colony up there, and Mr. Robb, the writer of the letter, is the man who has been in special charge of the nurseries.

* * * * * *

Yours, &c.
(Signed) Alfred Dent.

W. T. Thiselton-Dyer, Esq., C.M.G.,
Royal Gardens, Kew.

(Enclosure.)

The Peruvian Corporation, Limited,
(Colonisation Department),
27th July 1893.

Dear Sir,

I herewith beg to hand you my report on the colonisation, lands, prospects, &c., for the year ending 30th June.

Colonisation.—I very much regret to say that during the past year not so much progress has been made by the colonists as we could have wished. Some have done fairly well, and have now got a good footing on their lands, with nice crops of maize, yucca (*Manihot utilissima*), beans, vegetables, &c., and with a little ground cleared for planting coffee at the end of the year, and I think it but fair to especially mention the colonists around Metraro and Dentville as being the most industrious. Others have not done well, and have been the cause of much trouble and expense. A few have abandoned their chacras and left this part of the country, and some who remain will, I am afraid, never be successful.

The cause of this can without doubt be attributed to the most undesirable class of colonists introduced, such as runaway sailors and adventurers of every description, who arrived in the colony absolutely destitute, and without responsibility of any kind. It cannot be expected that such men will ever make successful colonists. Their wandering habits never allow them to remain long in a place, and work of any description is distasteful to them. A single man without means, let him be ever so good and anxious to do well, can never make any real progress or be a successful colonist. In the first place, he has to cook his food and attend to his house, which occupies a good part of his time, and, on the other hand, he cannot cultivate with any chance of success more than about three acres of land, the produce of which would barely keep him alive, far less enable him to repay his debts.

If successful colonists are to be established on the lands, they will have to be selected from a very different class than heretofore, and as a rule families only, with a little means of their own. With the kind assistance given by the Corporation they would, in a few years, form a home and reap the benefit of their labours.

I am very sorry to say that French and Italian colonists appear to lack that steady perseverance shown by the more northern races, and it is from the latter class I would recommend the trial of a few families. It would be far more satisfactory to have, say, a dozen good families with means of doing well than a host of greedy avaricious adventurers, whose whole aim is to get what they can out of the Corporation without doing anything in return.

The injudicious selection of lands has been the cause of much trouble and of colonists leaving, and it is a matter of regret that more care was not taken by the representatives of the Corporation who settled them. A number located at Punisas above San Luis had no possible means of getting out their crops, and in consequence have lost heart and left. Others have been settled on sand beds swarming with ants and other destructive insects, and cannot be expected to remain contented. These people have since been removed to better lands, and no doubt they will now do well.

It would be to the interest of the Corporation to seriously consider the introduction of colonists with means, as they would not only be the backbone of the colony, but would act as a stimulus to others. There are undoubtedly good men at home who would be only too glad to know of this territory and its capabilities, and with such colonists a very different result would be obtained.

Lands.—The lands around Perené are not of a desirable nature, and are unfit for anything further than light crops, such as maize, rice, &c., but a few miles down the river I have found excellent lands suitable for tropical cultivation of any kind. In most instances I found the lay of the hills so steep that cultivation was out of the question, but, on the

other hand, I also found valleys and slopes that would be hard to surpass in any part of the world, and it is in such localities that we can look for success.

There is a great variety of soil, and for the most part extremely rich. In many places I find a rich dark loam with a rocky, gravelly bottom, and in other places it inclines to a sandy clay. I would especially mention the valley of the Yuranaki as an exceptionally good site, both as regards lay of land and suitability of soil, but undoubtedly there will be other parts equally good when opened up.

Along the banks of the river several valuable claims are to be found, extending for hundreds of acres, and for sugar-cane or rice culture would be very profitable.

Cultivation.—It has never been my lot to live in a country where the necessaries of life can be so easily grown, and a colonist with a little foresight can soon furnish nearly all he requires for his table from his own estate. Maize, rice, vegetables, fruits, &c., all grow freely and with little or no trouble. Oranges, lemons, and citrons also grow in abundance, and with a little trouble orchards could be laid out and any quantity of fruit grown for canning purposes.

European fruits could in any places be planted and grown with success, and I hope the day is not far off when I may be able to introduce them.

Coffee, cocoa, coca and rice will, I believe, form the principal products of the Colony, and with judicious management rich harvests should be reaped. The climate here is especially adapted to the cultivation of coffee, which bears enormous crops without any trouble and very little expense.

Tea would, I believe, grow luxuriantly on the slopes, and is well worthy of a trial, although on account of the scarcity of labour it would never become a general industry, as it requires too much manipulation.

There are numerous other products found which are of immense value in the European markets, and when things are a little advanced I shall have time to look into the matter and report to you more fully on the subject.

As in every country, we have pests, and here ants are our greatest. To certain crops they do considerable damage, but if the land is well selected they can, with a little trouble and care, be so kept down that the damage done is trifling.

Timber.—With an outlet towards the Atlantic, the timber on the territory would become a source of great income. On walking through the forest I encountered immense trees of cedar, mahogany, "walnut" and rosewood. Some "walnut" trees near Metraro would give boards of about 15 to 18 inches wide, but with the present means of conveyance could not be exported. There must be a sufficient number of valuable trees growing within reasonable distance of the Perené and its tributaries to make lumbering an industry of great importance. Numerous other kinds of various qualities are found very suitable for boarding and general building purposes.

Nurseries.—I have now got about 10 acres of land cleared, and ground will soon be got ready for seeds of all kinds. At present I have coffee seeds sown, which should give about 80,000 plants, and with the extra seeds to be sown shortly will enable me to supply all demands for this season. A small bed of Huanuco coffee seeds sown last autumn

have done exceptionally well, and I hope to be able to have the seedlings planted out for seeding purposes as soon as the rains commence.

The introduction of Blue mountain coffee seeds would be of the greatest benefit, and could be set apart and grown to supply seeds for colonists.

A little later on I may be able to collect plants and seeds and make an exchange with the authorities of the Botanic Gardens, Jamaica.

Dentville.—Not much can be said about this little town in the meantime, but I have every confidence in saying that it will rise to be a very important place as well as a very pretty one. Although it lies rather low and is inclosed by an amphitheatre of hills, a strong breeze blows up the valley of the Perené, and makes the temperature nice and bracing.

During the rainy season a little trouble was caused by malaria, due no doubt to the dampness and the thick forest around, but I am of opinion that this will disappear as it is opened out.

Besides the Indians' houses, I have erected two new ones, which will suffice for the housing of the present population.

The plaza, or square, is now marked off, cleaned, and ready for buildings, and in due time the ground will be laid out with the necessary walks and beds.

Along the river bank, for about two miles, a splendid drive or walk can be laid down with very little expense, as the place abounds with palms and other ornamental trees, and I hope in due time to take this in hand.

Roads and Bridges.—In spite of the great difficulties to be contended with, I have great pleasure in saying that this important work is being carried on quickly. It is of the utmost importance to the rapid development of the Colony that special time and money be devoted to this great task, as without means of conveyance into the interior we can never expect to make any marked headway.

The road that is be constructed between Perené and Dentville is an excellent one, and when completed will be of the greatest importance to the Colony. Not only will it be a great highway into the interior, but vast tracks of valuable lands on both sides of it can be colonised.

The river communication is only open for a few months in the year, and no dependence can be put on the Indians for supplies or taking away produce. They dislike hard work of any kind, and having their own little affairs to attend to, no reliance can be placed on their services; also I may add that the navigation of the river to Dentville is so dangerous that balsas with cargo run a risk of getting upset on the journey down.

The bridges are also being pushed on, and in about two months I expect to see the bridge over the Paucartambo completed.

Prospects.—From an agricultural point of view the prospects of the Colony are very encouraging, and the colonist, notwithstanding the difficulties of establishing himself, will find his labours amply rewarded.

The man who is afraid of hard work need never come here, as an idler cannot get on in this country.

To men with a little capital this territory presents a field unsurpassed in any part of the world, and with roads a little more advanced hundreds of colonists can be settled within easy reach of the markets.

Every kind of produce sells readily, as the demand far exceeds the supply.

In concluding, I would add that all that is required to make this a great Colony is the emigration of colonists with a little means to give them an interest in their estates.

I remain, &c.
(Signed) Jas. Robb.

P.S.--I omitted to say, under the heading of "Nurseries," that one crop of rice and two crops of maize were raised at Dentville, as an experiment, with complete success.

In my next report I shall be able to deal more fully with these matters.

R. F. Mackenzie, Esq., J. R.
Perenc.

CCCXLVII.—HORTICULTURE IN CORNWALL.

The Cornish peninsula has a climate which in many ways lends itself to open-air gardening. The isotherm of 52° follows closely the contour of the coast. The winters are mild, frost is rare, and snow almost unknown; on the other hand, the summers are usually cloudy and rarely hot. These are precisely the conditions that the New Zealand type of vegetation peculiarily delights in; they are to be met with to some extent in Scotland, but scarcely at all in the east of England, where many Himalayan and New Zealand plants can only be grown with difficulty out of doors, and not always with success owing to the dryness of the summer air under glass.

The Assistant Curator of the Royal Gardens, Mr. Watson, and the Foreman of the Arboretum, Mr. Bean, spent a portion of their leave last autumn in the west of England. The following note, by Mr. Watson, gives some account of their visits (September 23–26) to a few representative gardens in South Cornwall, and affords a fairly representative picture of the possibilities of Cornish horticulture. It is substantially the same as that which appeared in *Garden and Forest* for October 25 last:—

The gardens in the south of Cornwall have a special attraction for horticulturists, many plants thriving out-of-doors there which in other parts of England must be grown under glass. The following notes were taken during a three days' ramble in the neighbourhood of Falmouth in September.

Himalayan rhododendrons are a feature of open-air gardening in South Cornwall. In several gardens near Falmouth, notably that of Mrs. Shilson, at Tremough, there is a large collection, and all the best known species are represented by enormous specimens. Another fine collection is that at Carclew, the residence of Colonel Tremayne, where, also, there are very fine examples of rare *Coniferæ*. There are also many large specimens of rhododendron and other tender shrubs and trees in the garden of Miss Fox at Penjerrick. Falmouth is exceptionally favoured in regard to climate, and, apparently, also in regard to suitable soil for these Himalayan rhododendrons.

I was informed by Mrs. Shilson's gardener, Mr. R. Gill, that eight degrees of frost is about the average maximum of cold experienced in the neighbourhood of Falmouth, and that heavy mists and rains occur frequently at all seasons of the year. Mr. Fox, of Grove Hill, obtained the Banksian medal about 30 years ago for "acclimatizing" upward of 200 foreign plants.

The Himalayan rhododendrons at Tremough are nearly all veterans, having been raised from seeds obtained from Kew soon after their first introduction by Dr. Hooker, now 10 years ago. They are now almost the sole occupants of very large shrubberies and spacious beds in various parts of a large garden, and there are also numerous specimens among the trees in the woods which partly surround the place. I measured some of the largest specimens. *R. arboreum*, trees 30 feet high, with trunks a foot in diameter; *R. niveum*, perfect, spherical bushes 12 feet high; *R. Falconeri*, 12 feet high, a grand specimen well furnished with large leathery leaves, a striking object at all times, but a magnificent sight when bearing scores of large trusses of flowers, as it does annually here; *R. barbatum*, 10 feet high, and furnished with branches down to the ground; *R. campanulatum* (*Wallichii*), abundantly represented by very large bushes; *R. ciliatum*, the largest plants I have ever seen, a bush six feet high and at least twice as much in diameter; *R. aboreum roseum*, *R. Shepherdii*, *R. cinnamomeum*, a variety of *R. arboreum*, and *R. Thomsoni*, all much larger than we are used to see them even under glass. A hybrid between *R. Thomsoni* and *R. barbatum*, raised in this garden, and named *R. Shilsoni*, is similar to the former in leaf and habit, differing only in the size of its heads, the colour of the flowers, and the shortness of the flower stalks, in which characters it is superior to *R. Thomsoni*, which is saying a great deal. *R. griffithianum* (*Aucklandii*), a delicate species as a rule, is in rude health and 10 feet in height. Seedlings are to be seen springing up in those parts of the garden which escape the hoe. In all the species there is considerable variety observable in the foliage and habit of the many representatives. This variation is due to the plants having all been raised from imported seeds, and not propagated by grafts or cuttings as is usual with garden rhododendrons. *Azalea indica* is as plentiful and large as the common Cherry Laurel is in northern gardens, while camellias occur frequently, and always in good health. As a rule, perfect flowers are cut from them for decorations at Christmas. At the time of my visit, the Belladonna Lily was the glory of the garden. Among the rhododendrons, along the carriage drive, against the terrace wall, and even in the kitchen garden, the flowers were as thick as cowslips in an English meadow. In the same garden a great bed on a large open lawn was filled with *Yucca gloriosa* and *Y. recurva*, about 30 plants altogether, with rosettes of healthy leaves a yard high, and each bearing a spike another yard high, clothed with white waxy bell flowers. They were a fine picture. Against the entrance, with its roots half choking a stream beside which it had been planted, stands a fine example of *Aralia* (*Dimorphanthus*) *mandshurica*. It is 30 feet high and 35 feet in the spread of its branches, its stem nine inches in diameter, and its flowers and fruit abundant. A few yards further on we saw a cottage almost entirely enveloped in a thick cloud-like mass of *Solanum jasminoides*, partially hiding the roof, and even the chimneys with its healthy green leaves and thousands of clusters of white starry flowers. This and the hardy fuchsias (*F. globosa* and *F. coccinea* chiefly) are favourities with the cottagers in Cornwall, where we saw many beautiful effects made by one or the other, and sometimes by the two combined, as they grew against the cottages by the roadside.

In Colonel Tremayne's garden *Rhododendron arboreum* is even larger than the largest at Tremough, having a stem four feet in circumference, while *R. Hodgsoni* is a great bush 15 feet through. *R. Falconeri* is 20 feet high, and this summer bore 96 trusses of flowers. I have never seen a more charming garden than this at Carclew; indeed, I question if there is anything better in Cornwall. The *Coniferæ* are

magnificent: *Abies Smithii*, 80 feet high; *Tsuga albertiana*, the same; *Pinus patula*, a magnificent example; *Pseudolarix Kœmpferi*, the Golden Larch, is 30 feet high, and would have been much higher had not its top been broken off by a storm a few years ago; its trunk is exactly 18 inches in diameter. *Phyllocladus rhomboidalis*, the celery-topped pine, is represented by a handsome specimen 15 feet high. An interesting feature of this garden is the Lucombe Oak, of which there are numerous very large trees, 90 or 100 feet high, with trunks as straight as pines and measuring 12 feet in circumference. The Lucombe Oak (Lucombe was gardener at Carclew) is an accidental hybrid between the Cork Oak and Turkey Oak. There are also in this garden a number of hybrids between other oaks. Of the genus *Pinus* there are rare species from Mexico, India, and California. Loudon described many plants flourishing at Carclew as of quite unusual dimensions and habits. Enormous bushes of Leptospermums, *Embothrium coccineum*, Azaras, *Berberis japonica*, var. *Beali*, a grand shrub, and *Benthamia fragifera*, a common tree covered with its large strawberry-like fruit, are among the many things I noted. A path bordered by clumps of Himalayan rhododendrons, white *Azalea indica*, *Azalea mollis*, and *Embothrium* must be a beautiful picture in May or June when they are in flower. Among many features of interest noted in the glasshouses two call for special mention. First, a collection of seedling Dipladenias, all from seeds of *D. Brearleyana*, and showing wide variation of colour, from pale rose to cerise and purple. They varied also in the size and form of the flowers, and indicated that a great deal might be done with Dipladenias if the seeds of the garden varieties were sown. The second feature is *Cæsalpinia* (*Poinciana*) *pulcherrima*, which is rarely seen in bloom in England, but which is flowered every year at Carclew by keeping it potbound and training its branches against the glass in a sunny stovehouse. *Myrtus Ugni* is grown as a kitchen garden plant, its fruits being made into jam.

At Enys, the well-wooded demesne of the old Cornish family of that name, there are some interesting and rare New Zealand trees and shrubs; among others, *Fagus Cunninghamii*, 20 feet high; Pittosporums, 30 feet; several species of *Eucalyptus*, a fine bush of *Olearia argophylla*, the musk tree; another of *Laurelia Camphora*, while the handsome Chilian *Lomaria procera*, with fronds as large and rigid as a *Zamia*, is common and apparently naturalised in the garden. *Photinia serrulata* is 30 feet high and 20 feet in diameter, with a trunk a foot through. *Myosotidium nobile*, a rare and handsome herb from New Zealand, is represented by a large clump suggesting a good stool of rhubarb; the leaves are crowded on stout stalks, the largest over a foot in diameter. *Desfontainea spinosa* is a common bush in the garden and is nearly always in flower. *Magnolia lenniana*, a variety of *M. conspicua*, was in flower, and is a very handsome plant, the flowers being large and of a rich claret-red colour. *Leptospermum scoparium* is a tree 15 feet high, and when in flower is like a pillar of snow. The woods are rich in big specimens of Turkey Oak and fine Silver Firs, some of them 120 feet high, with grand mast-like trunks. *Cupressus macrocarpa*, the pride of Cornish and Devon gardens, is represented at Enys by enormous trees, one I measured having a trunk 3½ feet in diameter. A lake among the trees in the lower part of the garden is very picturesque, being surrounded by suitable reeds, ferns, &c., while the banks are covered with a thick mass of *Primula japonica*. This plant has taken entire possession of the whole of the margin of the lake, and would, if allowed, soon obliterate the paths, seedlings coming up in

dense turf-like masses all over the gravel. In early summer when this crimson primrose is in flower it must be very fine.

In the gardens at Menabilly, the seat of Jonathan Rashleigh, Esq., there are many rare and fine examples of Coniferæ. I saw *Athrotaxis laxifolia*, 15 feet high; *A. imbricata*, 9 feet high; *Pinus oocarpa*, 20 feet high, a broad thick-stemmed specimem; *P. parviflora*, 9 feet high, said to be the largest example of this rare pine in the United Kingdom. *P. Montezumæ*, 20 feet high, and as wide; *Picea ajanensis*, *P. webbiana*, *Abies grandis*, and *A. Pindrow*, each in fine vigorous health, and about 20 feet high, while a beautiful little specimen of *A. religiosa* is nine feet high. *Retinospora leptoclada* is seven feet high. The genus *Podocarpus* is also represented by large examples. It will afford some idea of the suitability of this garden for conifers if I give the measurements of a pair of *Pinus insignis* which were planted in 1838 by Mr. Rashleigh. These are now 70 feet high, with trunks four feet in diameter.

Escallonias are notable sea-side shrubs, and in some parts of Cornwall *E. macrantha* is an admirable hedge plant. The large waving plumes of the beautiful bamboo, *Thamnocalamus Falconeri*, occur in many places in Mr. Rashleigh's garden, and always with telling effect. Indeed, these and thousands of bushes of *Hydrangea hortensis*, all bearing big bunches of rich blue flowers, are special features at Menabilly. An avenue planted with Yuccas, *Chamærops Fortunei*, and bamboos will be very effective in 15 or 20 years. The true *Cordyline indivisa* is here represented by large specimens with stems six feet high, bearing large heads of leaves six inches wide and three feet long, their colour yellowish-green, with brown stripes. The lawns are full of daffodils and other spring-flowering bulbs, the woods carpeted with hardy Cyclamens, and everywhere there are big bushes of Himalayan rhododendrons. The Chilian *Raphithamnus cyanocarpus*, a myrtle-like bush 12 feet high, was laden with bright China-blue fruits. Callistemons, Hakeas, Eurybias, *Embothrium*, Pittosporums, and even Acacias, are all represented by big bushes. *Litsea reticulata* is a tree 30 feet high, and *Rhododendron Falconeri* a magnificent specimen. *Abutilon vitifolium album* is at home on the lawn, forming a large shrub, and flowering freely in summer. Where it is happy, this is one of the most beautiful of all Malvaceous plants. On one side of the garden there is a valley, one side of the slopes of which is planted with many rare Coniferæ, and other trees and shrubs, obtained chiefly from Kew, Mr. Rashleigh having always maintained an active correspondence with the Royal Gardens. This slope has been named the "Hooker Grove," in compliment to Sir Joseph Hooker.

There are so many choice and tender plants in these Cornish gardens that one wishes to see many of the newer things tried there. So far as I could understand the conditions, they are favourable to nearly all the plants that can be cultivated in the open air in England, and also to a great many which, even at Kew, have to be grown under glass. Cornwall might easily be made a gardener's paradise, and there are, no doubt, many other places in the world where a little gardening enthusiasm, rightly applied, would add materially to their beauty and interest.

CCCXLVIII.—BOTANIC STATION, DOMINICA.

The *Kew Bulletin* for June contained a note on the work of the Botanical Station, Dominica. The following interesting letter from the Curator gives a very satisfactory report of its progress:—

Curator, Botanical Station, Dominica, to Royal Gardens, Kew.

Botanical Station, Dominica.
19th September 1893.

Sir,

I beg to acknowledge the receipt of several numbers of the *Kew Bulletin*, also a box containing a sucker of *Musa sapientum* var. *rubra*, and 200 seeds of *Raphia vinifera*.

I have also received viâ Antigua seeds of *Uncaria Gambier* and 24 other plants, being part of a consignment sent from Kew. Amongst the latter I have four plants of *Erythroxylon Coca* (true) Ceylon, *Zizyphus Jujuba*, and other interesting plants.

Some of the plants sent to me from Kew last year are doing very well. *Sandoricum lucidum*, a fruit-tree from Singapore, is now seven feet high. *Anamirta Cocculus* is growing freely; *Spondias borbonica*, *Croton Tiglium*, and *Garcinia Mangostana* are all doing well, and many of the others are becoming established, and I hope will grow freely now. I have, unfortunately, lost the plant of *Cephaëlis Ipecacuanha*. I greatly regret the loss of this plant, which was caused by the carelessness of the weeders. I hope Kew will be able to supply me with another plant.

You will be pleased to hear that the *Uncaria Gambier* is going to flower. On the large plant, which is now eight feet high, I counted 18 flower heads; the smaller plant only shows one flower head at present. I shall pay great attention to the plants, and if successful in obtaining seeds shall try my utmost to be successful with them.

I have recently been on a visit to Montserrat. During the week I visited the estates owned by the Montserrat Lime Company. Mr. Hamilton kindly showed me over the estates. The coffee cultivation is splendid. There are over 80 acres planted. The greater part is now bearing a fine crop. I strongly urge on planters, especially those who are taking up the cultivation of coffee, to visit Montserrat and note the kind of land selected and other points of value, and see what can be done by good cultivation. The cacao cultivation is very good. They are fortunate in possessing a very fine variety. It is robust, comes in bearing early, is most prolific and excellent in quality, good points not often combined in a single variety of cacao. I am glad to inform you that this variety is also being cultivated in Dominica, a large number of pods having been supplied through the Botanical Department direct to the planters, while all the plants sold from the station are raised from seeds purchased from the Montserrat Company. I also noticed several large fields under arrowroot cultivation.

The lime-tree does not seem to thrive so well in Montserrat as in Dominica. It is stated that the acidity of the Montserrat lime is greater than the Dominica lime. The Montserrat lime is small compared with the lime grown here. The trees here grow to a large size, and the crop borne is amazing. Even allowing for the greater acidity of the Montserrat lime, there can be no doubt that owing to the large size of the tree and fruit, and the immense bearing qualities, lime cultivation in Dominica must be more profitable than elsewhere. I also saw the fumigating process now adopted to free the scale insects from the lime

trees. It is known as the Californian process, and has been fully described in the *Kew Bulletin*. It may have to be introduced in Dominica sooner or later. Mr. Hamilton kindly showed me a coffee-pulper by Gordon & Son, and explained its working.

I was very pleased to have the opportunity of seeing some first-class cultivation.

We have had an exceedingly wet season, and it is most difficult to keep the station in order. The plant sales continue good; the total number of plants sent out from January to middle of September just exceeds the total number sent out during the whole of 1892. If the sales continue good during the remainder of the year I shall be able to show a considerable advance on last year's plant sales.

I am, &c.

(Signed) J. Jones.

CCCXLIX.—ST. VINCENT ARROWROOT.

The following communication is supplementary to the article which appeared in the *Kew Bulletin* for August last (pp. 191–204) :—

Mr. F. Watts to Royal Gardens, Kew.

Government Laboratory, Antigua,
December 12, 1893.

Dear Sir,

I note in the *Kew Bulletin* for August 1893, an account of the arrowroot industry in St. Vincent, and certain investigations in connexion therewith. Perhaps the following information, which is not contained in the *Bulletin*, may prove useful :—

Some time ago, I made an analysis of the ash of ripe arrowroot, and found that the fresh root, when cleaned and scaled, yielded 1·219 per cent. of pure ash, *carbon dioxide being deducted*. This ash contained :—

Silica	9·73
Phosphoric anhydride	12·24
Sulphuric anhydride	6·39
Chlorine	6·48
Oxide of iron	·22
Alumina	·13
Lime (C_aO)	3·18
Magnesia	5·39
Potash	54·06
Soda	2·14
	99·96

From this I estimate that a fair crop of arrowroot would remove from the soil about 80 to 90 lbs. of potash per acre, which I think would be a serious drain unless this is supplied by manures. And this is the more important as my analyses of St. Vincent soils, like those of Mr. J. Hughes, point to a deficiency of potash, phosphates, and nitrogen.

The amount of phosphates removed by a crop would be small, and that of the lime almost negligable.

It would seem, therefore, that a chemical manure for arrowroot should supply 80 lbs. of potash per acre, with a relatively small amount of

phosphate and nitrogen, and perhaps the amount of potash in the manure suggested by Mr. Hughes (*Kew Bulletin*, August 1893, p. 199), might be increased (perhaps *doubled*) with advantage.

Believe me, &c.
(Signed) FRANCIS WATTS.

CCCL.—COFFEE-LEAF DISEASE IN CENTRAL AFRICA (PREVENTIVE MEASURES).

FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, September 16, 1893.

I AM directed by the Earl of Rosebery to transmit herewith an extract of a Despatch from Her Majesty's Commissioner in Central Africa, enclosing regulations which he proposes to issue prohibiting the importation into British Central Africa of any seeds or plants likely to introduce the leaf disease of the coffee shrub.

Lord Rosebery would be glad to be favoured with any observations which the Director of Kew Gardens may have to offer upon these papers.

I am, &c.
(Signed) P. W. CURRIE.

The Assistant Director,
Royal Gardens, Kew.

EXTRACT.

I HAVE the honour to submit to your Lordship for approval and sanction the following regulations prohibiting the importation into British Central Africa of any seeds or plants likely to introduce the leaf disease of the coffee shrub into British Central Africa.

In April last I was approached on this subject by the Planters' Association of the Shiré Highlands. It was pointed out to me that the introduction of the leaf disease of Ceylon into the coffee plantations of Central Africa would simply ruin the commencing prosperity of the country, inasmuch as coffee is the one source of wealth which this Protectorate possesses.

ROYAL GARDENS, KEW, to FOREIGN OFFICE.

Royal Gardens, Kew,
SIR, September 16, 1892.

I HAVE the honour to acknowledge the receipt of your letter of yesterday's date, enclosing an extract from a Despatch from Her Majesty's Commissioner in Central Africa respecting regulations proposed to be issued for the purpose of preventing the introduction of leaf disease in coffee.

2. I do not think that Mr. Johnston puts the matter at all too strongly when he states that if such a calamity were to happen "it "would simply ruin the commencing prosperity of the country."

3. The subject of leaf disease in coffee has engaged the continuous attention of this establishment almost since its first appearance in the East. At present the coffee-growing countries of the New World are, as far as is known, entirely free from it. Strenuous measures have been taken by the Colonial Office, acting under the advice of this establishment, to prevent its introduction into the West Indies.

The following extract from a letter addressed by Kew to the Colonial Office, December 8, 1890, will be found, perhaps, useful to Lord Rosebery as a summary of the present history of the subject :—

" 3. As you are aware, the subject of the diseases which affect the coffee plant in different parts of the world has received very attentive consideration at Kew. It appears to me that it is desirable to examine the present condition of the question as regards Jamaica with some care, as there are in the papers which you have transmitted to me some rather serious misconceptions about it.

" 4. As is well known the leaf disease of the coffee which has proved so disastrous to its cultivation in Ceylon is due to the attacks of a microscopic fungus, the spores of which it has been shown are carried by the atmosphere with great facility, and which, therefore, spreads with frightful rapidity in a country where large tracts are devoted to coffee cultivation. All the evidence seems to point to the fact that this fungus, which before it made its appearance on a large scale amongst coffee in Ceylon was unknown to science, is a species endemic to the island. Like thousands of other microscopic leaf-fungi, it probably maintained its existence in an unconspicuous manner in some native Rubiaceous plant (*i.e.*, belonging to the same family as the coffee). It was probably only by a kind of accident that about 1869 it found a suitable host in cultivated coffee, and thus was enabled to develop itself on a scale which speedily made it a scourge.

" 5. I can hardly doubt that it was from Ceylon that it was almost immediately conveyed to Southern India, to Sumatra (1876), Java (1879), and Mauritius (1881). It is also practically certain that it was directly introduced into Fiji from Ceylon. Dr. MacGregor, who was charged with the duty of attempting to stamp it out in Fiji, reported July 26, 1879, to the Lieutenant-Governor: 'Probability is pretty 'strong that the disease was introduced in, and spread from, the 'charcoal packing of imported seeds. . . . . It is, however, by 'no means impossible that the disease was introduced in the clothing 'or personal effects of some person or persons arriving in Fiji from 'Ceylon.'

" 6. On July 1, 1884, Sir Joseph Hooker informed the Colonial Office that the disease had made its appearance in Natal. In what manner the infection had been brought about has not, as far as I know, been ascertained.

" 7. It is, however, clear that, starting from Ceylon, a wide area has been progressively infected, extending, at the present time, from Natal in one direction to Fiji in the other. Within this area it can hardly be doubted that the disease has been disseminated to countries and places where no one has been at the pains to record its occurrence.

* * * * *

" 14. The *Hemileia* is without exception the most destructive fungoid scourge known. It exceeds even the potato disease, because that does not ravage the crop with persistent violence year by year. The *Hemileia*, on the other hand, when it has settled on a plantation, remorselessly, if somewhat slowly, destroys it. Its action has necessarily largely restricted coffee cultivation to the Old World, and to that extent the risk of transporting it which attends the abundant communication which now takes place between individual colonies is diminished. Still, sooner, or later, the spores will probably be carried across the Atlantic. In the meantime it appears to me to be the interest of every uninfected coffee-growing country to intercept its invasion."

4. It will be seen that with the exception of tropical Africa the whole coffee-growing area of the Old World is now infected.

5. I fear that the introduction of the scourge into Central Africa is only a question of time. Should such a calamity occur its consequences might be mitigated if coffee cultivation were not carried on over large continuous stretches of land, but the plantations were kept separate by belts of trees to windward. The spores of the fungus are carried readily by the wind. When a plantation is infected it may be cleansed and the fungus in its nascent state destroyed by powdering the trees with a mixture of lime and sulphur, but unless the access of fresh spores can be arrested, the plantations may be readily re-infected when the lime and sulphur is washed off by rain. The presence of belts of trees would mitigate this by arresting the spores.

6. I am always reluctant to concur in regulations which must have a restrictive effect, even if small, on commercial enterprise. But in the present case it is impossible to accept the risk of ruining an important and developing industry, which is an important factor in the successful colonisation of British Central Africa. It appears to me that Her Majesty's Government have no choice but to follow the precedent already set in the case of Jamaica.

7. The proposed regulations will, however, require revision. As already pointed out, the whole of the New World is free from leaf disease. South America need not therefore be included. On the other hand, the *whole* of the coffee-growing countries of the Old World appear to be infected. To be of any use, the regulations must include Mauritius, the Straits Settlements, Java, Sumatra, and the Dutch East Indies, as well as the Malayan region generally.

Zanzibar is, no doubt, included as a general *entrepôt* from the East. The weak point in the defence is undoubtedly Natal. Coffee cultivation is carried on there, I believe, on only a small scale, and it is almost inexplicable how it can have become infected. A case like this, I confess, leads me to take a gloomy view of the whole position, and to incline to the belief that sooner or later the disease will establish itself through the coffee cultivation of the whole world despite every precaution. The severest restrictions did not prevent the Phylloxera being introduced from Europe into South Africa, even though a competent scientific opinion had been given to the effect that the passage of the Equator would be a natural bar to its southern dispersion.

I may add that I have no evidence on the point, but think it extremely probable that Madagascar is infected.

I am, &c.

Sir Philip Currie, G.C.B., (Signed) W. T. Thiselton-Dyer.
Foreign Office,
Downing Street, S.W.

CCCLI.—WEST AFRICAN BOTANIC STATIONS.

The volumes of the *Kew Bulletin* since 1888 contain numerous notices of the progress of the attempts made by means of the Botanic Station system to develop the material progress of the West African Colonies.

These attempts were at first necessarily in great measure tentative and experimental. They have now attained a sufficient measure of success to cause the Stations to be regarded as institutions of permanent

usefulness. The following correspondence places on record the official action which has taken place in consequence :—

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, September 25, 1893.

AFTER the recent meeting of the four West African Governors at the Colonial Office, which you and Mr. Morris were kind enough to attend, and at which the steps to be taken for extending the Botanic Station System and developing technical education in those Colonies were discussed, a memorandum was drawn up embodying the conclusions arrived at on that occasion.

I am now directed by the Marquis of Ripon to enclose for record in your Department, a copy of this memorandum, and I am to state that his Lordship approves of the suggestions contained therein.

I am, &c.

The Director, (Signed) JOHN BRAMSTON.
Royal Gardens, Kew.

The Development of the Botanic Station System and of Technical Education in the four West African Colonies.

At a conference of the four West African Governors, the Director, and Assistant Director of the Royal Gardens, Kew, which was held at the Colonial Office on the 12th of September 1893, it was decided that it was desirable that :—

(1.) The Curator of a Botanic Station should be made a permanent official.

(2.) His salary should be 200*l.* a year, rising by annual increments of 16*l.* 13*s.* 4*d.* to 250*l.* a year.

(3.) He should receive travelling allowance according to his rating.

(4.) He should be entitled to the benefit of the Colonial Regulations regarding the leave, passages, pensions, &c. of West African Officials.

As regards *Training in Agriculture*, it was agreed that the following course should be adopted as far as possible :—

(*a.*) *Training Lads at Botanical Stations.*—This might be regarded as a first step in the direction of teaching boys in agricultural pursuits. Intelligent boys should be attracted to the work under a definite arrangement made with the Government for their future career. The lads might receive a small sum at first towards their maintenance, to be gradually increased year by year as they improved. The training should be thoroughly practical and suited to the circumstances of the Colony. Of these lads the best might be selected for further training in the West Indies or at Kew. When qualified the trained lads might be employed (1) as officers in charge of branch botanic stations; (2) as managers of private plantations; (3) as instructors in agriculture in schools; (4) to replace the Curator when occasion may require. The number of lads in training should be regulated by the capacity of the Station. The Curator should not be burdened with the board and lodging of the lads. The arrangements for training should be entirely in the hands of the Curator. It will probably be found best to place each lad singly under the training of one of the workmen, and move him from one kind of work to another, as circumstances arise. The whole training should extend over four or five years at least.

(*b.*) *Branch Botanic Stations.*—As circumstances demand branch stations might be started in various parts of the Colony. These could be placed under charge of trained natives supervised by the Curator

from head quarters. These branch stations would become in time valuable agencies for the diffusion of agricultural knowledge, they would act as depôts for plants sent from the Chief Botanic Station; and they might devote attention to the special kinds of products suited to the district in which they were placed.

As regards *Instruction in Handicrafts* it was agreed that no general scheme could be devised, but that each Governor would submit a scheme adapted to the requirements of his Colony as soon as possible after his return.

(Signed) W. Brandford Griffith.
W. Fleming.
G. T. Carter.
R. B. Llewelyn.

A step had already been taken in the Colony of Lagos to train young African lads so as to fit them for such duties as the charge of branch botanic stations. In this, as in so many other matters likely to conduce to the development of the West African Colonies, Sir Alfred Moloney, the Governor of Lagos, took the initiative. Two young men, Thomas B. Dawodu and Ferdinand G. Leigh, were sent in October 1890 to the Botanical Department, Jamaica, for training, and in April of the present year were transferred to Kew. They evince considerable aptitude for horticultural work, and it is hoped will be returned to the Colony with a sound and professional knowledge of the general principles of cultivation and of all that relates to plant propagation.

The progress of the Botanical Station on the Gold Coast has been recorded from time to time in the *Kew Bulletin* (see *infra*, pp. 160–62). The Curator, now on leave (see *infra*, p. 66), has accompanied the Governor, Sir Brandford Griffith, on a visit to the West Indies, which cannot fail greatly to enlarge his experience.

The following extracts from his report for the period ending June 30 last, afforded satisfactory evidence of the work which has been accomplished at the station. The plants now experimentally introduced can hardly fail to lay the foundation of many important future industries.

"The whole of that portion of land between the Banana Walk on the west, and the Akropong Road on the east, has been planted with Arabian Coffee.

"The piece of land situated near the town of Aburi, on the Akropong Road, which was cleared in December last, has been planted with Liberian Coffee, and the boundary of Cocoa-nuts completed around it.

"All the land extending from the west end of the house and to the right of the road leading to Aburi, has been completely planted with Cacao.

"Besides the above, a large number of other valuable economic plants and fruits have been planted out into permanent places. Some of the most valuable of these plants are the following:—

18 plants of *Hevea spruceana*. This plant is the source of the valuable British Guiana rubber. 'Fine Para is the standard by 'which all other grades are measured; it brings the best price, and 'probably is used more than any other;'

12 plants of *Castilloa elastica* or Central American rubber. This tree produces the rubber of British Honduras, Nicaragua, Guatemala, Mexico, and Guayaquil;

6 plants of *Artocarpus integrifolius*—the Jack fruit;
12 plants of *Achras Sapota*—the Sapodilla, a valuable West Indian fruit;
4 plants of *Cinnamomum zeylanicum*—the bark of which produces Cinnamon;
6 plants of *Caryophyllus aromaticus*—the dried unexpanded flowers of which produce the Clove;
6 plants of *Eugenia Pimenta*—the dried unripe fruit of which produces Pimento, or Jamaica Pepper, also known as Allspice;
6 plants of *Myristica fragrans*—the Nutmeg;
4 *Chrysophyllum Cainito*—the Star Apple;
8 *Anona squamosa*—the Sweetsop;
and a large number of other plants.

"All plants previously planted out have made a marked improvement during the last six months. They have grown luxuriantly, and many have borne fruit.

"*Coffee.*—Both the Liberian and the Arabian varieties are bearing their first crop of berries. The trees are in a most healthy and robust state, and give promise of a good crop.

"*Cacao* is also doing very well. I have already gathered more than 100 pods, which have been utilised for seed, most of which have germinated satisfactorily. The trees are again bearing heavy crops."

CCCLII.—MISCELLANEOUS NOTES.

Mr. Henry James Davies, a member of the gardening staff of the Royal Gardens, has been appointed a gardener for service in the Royal Botanic Gardens, Calcutta and Darjeeling.

Mr. John Robert Ward, a member of the gardening staff of the Royal Gardens, has been appointed Superintendent of the Public Gardens at Nagpur, Central Provinces, India.

Mr. William Lunt, a member of the gardening staff of the Royal Gardens, has been appointed, with the approval of the First Commissioner of Her Majesty's Works and Public Buildings, botanical collector for Kew to Mr. Theodore Bent's expedition to the Hadramaut Valley in South Arabia. The flora is only conjecturally known, and no botanical collections appear even to have been made in it. The expedition left London on November 24th, and is expected to return about April of next year.

It is with great regret that intelligence has been received at Kew of the abolition by the Government of Queensland, amongst numerous other posts, of that of Colonial Botanist, held by Mr. Frederick Manson Bailey, F.L.S. Mr. Bailey is held in high esteem in the Colony, and "strong efforts were made to induce the Government to "reconsider their decision so far as the Colonial Botanist was "concerned." Mr. Bailey was one of the recent explorers of the Bellenden-Ker range, and has contributed to Kew type-specimens of

the numerous additions that he has made to the flora of Queensland, and indeed of Australia (*Kew Bulletin*, 1891, p. 275). The Colony is so largely dependent on its botanical resources that it cannot dispense with the services of a botanical expert more than temporarily. It is to be hoped that in the meantime the organisation of the Colonial Botanist's office will be maintained, and the valuable Government Herbarium properly cared for.

Dermatobotrys Saundersii.—This is a new and interesting genus of *Scrophulariaceæ*, which was created by Mr. H. Bolus from specimens supplied by Mrs. Katherine Saunders, of Natal, an old and valued correspondent of Kew. A figure and description of the plant were published in *Hooker's Icones Plantarum*, t. 1940. In 1892 Mrs. Saunders forwarded fresh seeds of it to Kew, and from these a large batch of plants were raised, which have since been freely distributed. Several of the plants at Kew are now in flower. They are about a foot high, branched, the stems succulent, the leaves fleshy, oblong-ovate, serrated, glabrous, with rose-tinted veins. The flowers are produced in whorls just below the new leaves, each flower being tubular, 1½ inches long, with five regular teeth, the colour outside bright red, the inside yellow.

The following information with respect to the habit and peculiarities of this plant has been supplied by Mrs. Saunders, from Eshowe, Zululand, June 27th, 1892 :—

"Having been staying some time with my son, who discovered the *Dermatobotrys* you kindly named after him, I avail myself of the opportunity of being here in its flowering season, which has lasted already several weeks, to send more specimens of it. In the small box now posted with this, I send some roots of the *Dermatobotrys* which have been detached from the tree, upon which it is epiphytic. They are certainly different from the aërial roots of any plants I have seen. Although it grows normally upon trees, it also occurs growing on the ground. I have put in some ripe seeds, which I trust will enable you to introduce the plant into gardens at home, for it would be a great ornament to any garden, both flowers and foliage being handsome." Specimens of this plant in fruit only in the Kew Herbarium were collected by the late Mr. Gerrard in Natal 20 years ago.

Ilex paraguensis.—In the *Kew Bulletin* for 1892, p. 132, will be found some notes on certain plants yielding Paraguay Tea or *Yerba de Maté*, one of the most important economic products of South America. Until recently, the plant generally grown in gardens for *Ilex paraguensis* was *Elæodendron quadrangulatum;* this has large shining green laurel-like leaves, and is totally unlike the plant from which Paraguay Tea is obtained. In September last, Kew received, through the kindness of Señor Glaziou, Director do Passeio publico, Rio de Janeiro, seeds of the true *I. paraguensis*, some of which were sown and the remainder distributed to the following Botanical Gardens :—Antigua, Calcutta, Ceylon, Demerara, Edinburgh, Jamaica, Natal, Paris, Singapore, and Trinidad.

Palo Santo, or Holy Wood.—In the "Report for the year 1892 on the Trade of the Province of Santa Fé" [No. 1161, Annual Series, F.O., 1893, p. 4], Mr. Consul Bridgett furnishes a Table of Exports from Rosario, including a reference to Holly wood, of which 159 logs were exported during the year 1891–92.

As the museum collection did not contain a specimen of this so-called Holly wood from the Argentine, application was made through the Foreign Office to H.M. Consulate, Buenos Ayres, for a sample of the wood, together with flowers, fruits, and leaves, by which to identify its botanical source.

In response to this application information was received from Mr. Vice-Consul Mallet, British Vice-Consulate, Rosario, correcting the name Holly wood to that of "Palo Santo" or Holy wood, the error in spelling having occurred in a broker's list of exports, from whence the note in the table referring to this wood was obtained.

Subsequently, Mr. Vice-Consul Mallet forwarded a specimen of the timber which had formed one of the Argentine exhibits in the Paris Exhibition, 1889, but as no specimen of the plant could be obtained until the spring, the exact identity of the wood must remain yet undetermined, but judging from its structure and density it is doubtless furnished by a species of *Guaiacum*, and perhaps identical with Lignum Vitæ (*Guaiacum officinale*, L.)

The tree producing Holy wood is said to grow chiefly in "Chaco," and is used in the manufacture of furniture.

Pine apple Fibre.—This product has been noticed in the *Kew Bulletin* for 1887 (April), and 1893 (p. 208). A sample of excellent quality and extraordinary length, grown at Malacca, has been brought to this country by Mr. R. Derry, Assistant Superintendent in the Garden and Forests Department of the Straits Settlements. The following communication gives an estimate of its commercial value :—

Messrs. Ide and Christie to Mr. R. Derry.

72, Mark Lane, London, E.C.,
8th December 1893.

Dear Sir,

We have had to-day a call from our manufacturer, to whom we gave samples of your pine-apple fibre. Although his treatment of it is not completed yet, he is satisfied that he could use it in large quantities, say 1,000 tons a year or more, at a price of 30*l.* per ton in London. This may be some encouragement to you and your planter friends in the Straits Settlements to organise the planting of pine-apple to yield fibre on a commercial scale. Of course as you cannot make any engagement at present to deliver a reasonably large quantity within a period of six or twelve months, it is impossible to bring our friend to actual *business* just now. He tells us it is more difficult to bring this fibre to a spinning condition for fine yarns or fabrics than even Ramie or China Grass, but he thinks the results are good and would reward the care taken in its manufacture.

Yours faithfully,
(Signed) Ide & Christie.

Tibet.—Professor C. S. Sargent, Director of the Arnold Arboretum, Brookline, Massachusetts, has presented to Kew the plants collected and dried by Mr. W. W. Rockhill, formerly Secretary of the United States Legation at Pekin, on his last adventurous journey in Mongolia and Central Tibet. The collection consists of about 50 species, some of them probably undescribed. It will shortly be worked out and the results appended to Mr. W. B. Hemsley's forthcoming paper on the plants collected by Dr. Thorold, who accompanied Captain Bower on his equally memorable journey from Western Tibet to China.

Lagos.—Dr. Rowland has sent a further collection of about 300 dried plants, which, with previous collections recorded in the *Kew Bulletin* (1893, p. 146), have been approximately determined and the duplicates distributed to other botanical establishments with which Kew exchanges.

South Africa.—Mr. Harry Bolus, F.L.S., a resident near Cape Town, who has been some months at Kew studying his latest discoveries in connexion with the materials in the Herbarium, has presented a century of dried plants, consisting of new, rare, and interesting species, chiefly of his own collecting. The same gentleman has presented a copy of the first part of his illustrated work "Icones Orchidearum Austro-Africanarum." It contains 50, with few exceptions, coloured plates of South African orchids. The figures are excellent and the analyses of the flowers very complete.

From Mr. E. E. Galpin, of Queenstown, Kew has received a parcel of about 60 species of dried plants, including many of great interest, among them a flowering specimen of *Sterculia Murex*, described in the *Kew Bulletin* (1893, p. 155). A figure with a fuller description will shortly appear in *Hooker's Icones Plantarum*, t. 2278.

China.—Mr. T. L. Bullock, H.B.M. Consul at Newchang, has presented a collection of about 150 species from North China.

Smyrna.—From Mr. E. Whittall, Kew has received another century of dried plants sent chiefly with the view of a selection being made of such as were deserving of cultivation.

Malaya.—Mr. H. N. Ridley, F.L.S, the Director of the Gardens and Forest Department of the Straits Settlements, has sent a further collection of dried plants, numbering some 500 species; and Mr. Curtis, Assistant Superintendent at Penang, a collection of 100 species, partly from Siamese territory.

Pepper Cultivation.—Considerable difficulty appears to be experienced at the West Indies in the successful cultivation of pepper, for which a market might readily be found in the United States.

Mr. R. Derry, Assistant Superintendent, Garden and Forest Department, Straits Settlements, now in this country on leave, has supplied the following account of the method of cultivation pursued in the colony.

The method usually adopted with pepper in the Straits Settlements is as follows:—

Fruiting vines are set aside as stock plants for propagating. This is done by layering, but only strong branched shoots are selected, and all superfluous shoots are removed. It is necessary to be careful about the selection of shoots for layering, as certain shoots never produce fruit.

When rooted the young plants are transplanted to prepared holes, and, when the vine commences growing, posts are planted for support. Posts are preferred from large trees of durable wood, split up, about 10 feet long and about 10 inches wide, varying from $\frac{1}{2}$ inch to 6 inches in thickness. The vines are carefully tied and trained on the posts, all superfluous shoots pruned until the plant reaches the top of the post.

When growing the plants are kept mulched with burnt earth, and dressed with liquid manures as soon as fruiting commences.

During hot weather the roots are protected with straw of some kind. The fruits are picked when red, and kiln dried.

R. Derry.

3rd November 1893.

Wattle Bark.—The cultivation of Wattles (*Acacia, spp.*) for the production of tanning barks at one time appeared to be likely to become a profitable industry in suitable climates. According to Maiden "'Wattles and Wattle-barks,' *Acacia saligna* in South-west Australia "is the principal source of tan bark, and is said to contain nearly 30 "per cent. of tannic acid." On the other hand *Acacia pycnantha* yields "one of the richest tanning barks in the world; a richer may exist, "but I do not know of it." A sample yielded 46 per cent. of tannic acid and ordinarily it appears to average from 35 to 40 per cent.

The cultivation of *Acacia saligna* in South Africa appears to have been unremunerative. Mr. D. E. Hutchins reports:—

"The failure of *Acacia saligna* bark on the London market is serious, and threatens to greatly reduce the profits on wattle-planting. I am not very sanguine that *A. pycnantha* will be able to replace *A. saligna*. The position, so far as my observations extend, seems to be that the growth of *A. pycnantha* is uncertain, and that although its bark is about twice as rich as *A. saligna*, the growth may be only about one half as rapid. On the other hand the vigorous and rapid growth of *Acacia saligna* will probably render it remunerative to grow in most cases as fire-wood. A native of Western Australia it finds in the Cape Peninsula a nearly identical climate, and flourishes like most of the other Western Australian species. Should the shipment of *A. saligna* continue to prove unremunerative, it will be necessary to try the manufacture of tan extract. Kutch-boiling is practised on a large scale in many of the forests of India and Burmah with very rude appliances."—(Extract from the Reports of the Conservators of Forests, Cape of Good Hope, for the year 1892.)

Strawberries in India.—According to Mr. M. A. Lawson, Government Botanist, Madras, strawberries grown in the Nilgiris revert to a feral form (*Kew Bulletin*, 1892, p. 106.) It is not easy to see why this should be the case if they are propagated from runners. A collection of seeds of the best kinds was procured and sent out to Madras, and Mr. Lawson records the results, which are so far satisfactory in the following extract from the Annual Administration Report of the Government Botanical Gardens and Parks, Nilgiris, 1892–93 :—

"The following varieties raised from seed obtained from Kew have produced fine fruit, and promise to do well on these hills :—*Sir Charles Napier, Waterloo, Crescent seedling, Duc de Malakoff*."

Gambia Native Medicines.—Mr. J. H. Ozanne, Travelling Commissioner for the Gambia, West Coast of Africa (who had been supplied with a botanical outfit from Kew), has sent a small collection of plants from the northern bank of the Gambia, accompanied by some brief notes on the medicinal uses of some of them. Though the plants and their uses are for the most part well known, it may be of some interest to record the identification of the native names with the species as determined at Kew.

The following are the principal plants referred to :—

Anona senegalensis, Pers. Called "Diorgud" by the natives. The leaf heated and soaked in water, is used in diarrhœa and for griping pains in the stomach. The petals of the flowers are used on the Niger for flavouring country dishes.

Cochlospermum tinctorium, Rich. "Foosca" of the natives. A decoction of the roots is given to assist women in labour. The plant is well known in the Soudan for a yellow dye obtained from the roots.

Sclerocarya, sp. It has not been possible to determine the species of this plant. By the natives it is called "Dib." The gum is dissolved and mixed with soot and used for ink. The fruit resembles a greengage, and the juice is boiled down to a thick black consistence, and used by the natives for sweetening their "cherree," or Guinea corn gruel.

Cassia sieberiana, D.C. A small tree, called by the natives "Guamgua." The root is steeped in water, and the infusion used to promote the flow of urine (yellow fever).

Combretum, sp. This plant, called by the natives "Topp," has not been specifically determined. The gum is used for the cure of toothache, and a decoction of the root is given to relieve pains in the stomach.

Sphæranthus hirtus, Willd. This is a common weed, called by the natives "Lookidge." It is gathered and spread thickly on beds on which sick persons are laid, as it is said to relieve pains in the body and limbs and to induce sleep.

Ocimum basilicum, L. A very common weed, much used by the natives, who soak it in water and drink the infusion for "cooling the blood."

Viticulture in Uruguay.—Mr. Vice-Consul Greenfell reports from Monte Video :—

During the last three or four years an increased interest has been shown in the cultivation of the vine, and it has assumed considerable proportions in the districts of Salto, Paysandú, and in the vicinity of Monte Video. The country generally is well adapted for the growth of the grape, but the wine manufactured as yet is not of a

high-class character, and principally of the red description. Want of experience and knowledge of treatment may be the cause of this, but every effort is being made to improve the quality and extend the industry, for, on account of the high tariff on all imported wines, there is a ready demand for as much as can be produced.

The appearance of the phylloxera (*Phylloxera vastatrix*) has caused a certain alarm amongst the vine-growers, but stringent measures have been taken by the Rural Association to prevent the propagation of this justly-dreaded scourge of the vine. The spread of this pest would be a serious calamity for this country just at a moment when the wine industry is assuming important proportions, with every prospect of a wide development.

Hitherto the phylloxera has been unknown in Uruguay, and it has doubtless been introduced by plants or cuttings brought from countries where the plague existed. These are now strictly prohibited from being imported from Europe in either shape, with the hope of preventing, if possible, the further multiplication of the blight into the country.—(F. O. Reports, 1893, Annual, No. 1,294, pp. 10, 11.)

British Fungus-Flora.—Volumes II. and III. of this work (*see infra*, p. 26) have been published by Mr. G. Massee, Principal Assistant (Cryptogams) in the Herbarium of the Royal Gardens, and include the remainder of the *Basidiomycetes* and the whole of the *Hyphomycetes*. The three volumes contain full descriptions of 2,500 species, and generic types are illustrated by 340 figures.

INDEX.

A.

Abraham's Oak, 226.
Acacia pycnantha, 370.
— saligna, 370.
Acidanthera æquinoctialis, 145.
Additions to Gardens, 21, 111, 112, 145, 147, 186.
— — Herbarium, 66, 145, 146, 224, 225, 343, 369.
— — Library, 22, 147, 369.
— — Museums, 22, 145, 187, 225, 226.
Africa, Central, Coffee-leaf disease, 361.
African dried plants, 343.
Agave decipiens, 207.
— plants, poling in, 315.
— rigida, var. elongata, 320.
— — — sisalana, 206, 315.
— vivipara, 78.
Aldabra Islands, 152.
Aleurodes cocois, 44.
Aloe abyssinica, var. laxiflora, 340.
Alpine plants, Australian, 112.
America, dried plants, 146.
American Ginseng, 71.
Anona senegalensis, 371.
Anthracnose in vines, 228.
Appointments, 20, 65, 66, 111, 144, 340, 366.
Aralia quinquefolia, 71.
Araucaria imbricata, 24.
— Wood of, 225.
Arrowroot, 331, 360.
— in Grenada, 333.
— — Queensland, 331.
— — St. Vincent, 191, 360.
Artemisia maritima, 126.
Arundo from the Shiré Highlands, 341.
— madagascariensis, 341.
Asia Minor, bulbs from, 147.
— — dried plants, 146, 224.
Attar of roses, 22.
Australasia, dried plants, 146.
Australian Alpine plants, 112.

B.

Bailey, Mr. F. M., 366.
Bamboo from the Shiré Highlands, 341.
—, Sierra Leone, 169.
Barbacenia, 20.
Barbados Bulletin, 350.
— cane diseases, 149, 345.
Beefwood trees in West Africa, 25.
Belgium, Horticulture in, 162.
Bibiru, 117.
Bobo, 77.
Books, 22, 26, 69, 147, 227, 372.
Bornean dried plants, 224.
Botanic Gardens, Brisbane, 147.
— —, Buitenzorg, early history of, 173.
— Station, Dominica, 148, 359.
— —, Gold Coast, 160.
— Stations, West African, 363.
Botanical enterprise in 1796, 80.
— exploration of Sikkim-Tibet frontier, 297.
Bowstring hemp in United States, 208.
Brassica chinensis, 344.
Brisbane Botanic Gardens, 147.
British Fungus Flora, 26, 372.
— Honduras, resources of, 326.
— —, Palm Weevil in, 27.
— North Borneo, Gambier in, 139.
Brunnissure vine disease, 227.
Buckwheat, common, 3.
— Indian, 3.
— Kangra, 1.
Buitenzorg Botanic Gardens, early history of, 173.
Bulbs from Asia Minor, 147.

C.

Cacao-growing in Grenada, 136.
Cacao in British Honduras, 327.

U 79561.—3. 1375.—1/94.

California, prune cultivation in, 175.
Californian dried plants, 66.
— fruit industries, 218.
— vine disease, 227.
Canary rosewoods, 133.
Candelillo, 67.
Cape, fruit growing at the, 8.
Caryophyllus aromaticus, 17, 80.
Cassia sieberiana, 371.
Casuarina equisetifolia, 25.
Caucasus, plant industries in, 223.
Celtis australis, 145.
Central Africa, Coffee-leaf disease in, 361.
Ceylon, Para rubber in, 159.
Chestnut bark, extract of, 229.
Chinese dried plants, 369.
— white wax, 84.
Clove cultivation in 1796, 80.
— industry of Zanzibar, 17.
Cochlospermum tinctorium, 371.
Cocoa-nut in British Honduras, 328.
— — palm, fever in, 41.
— — — weevil, 27.
Coffee cultivation in the New World, 321.
— disease, 67.
— enterprise in the East Indies, 123.
— husking in London, 128.
— in British Honduras, 328.
—, Liberian, 25, 167.
— —, husking, 132.
— —, pulping, 204.
—, native, in Sierra Leone, 167.
Coffee-leaf disease in Central Africa (preventive measures), 361.
Cohune oil in British Honduras, 328.
Coix gigantea, 76.
Colletotrichum falcatum, 347, 348.
Colonial Botanist, Queensland, abolition of post, 366.
Combretum sp., 371.
Convolvulus floridus, 133.
— scoparius, 133.
Cooke, Dr., retirement of, 144.
Coprosma pumila, 112.
Cornwall, Horticulture in, 355.
Cotton seed, Sierra Leone, 169.
Cytisus proliferus, 115.
— —, var. palmensis, 115.

D.

Davies, Mr. H. J., 366.
Dear, Mr. G., 111.
Decades Kewenses, 11, 155, 209.
Dermatobotrys Saundersii, 367.
Development of the Botanic Station system in West Africa, 364.
Dewar, Mr. D., 65.
Dischidia rafflesiana, structure of, 113.
Disporopsis, 344.
Dominica Botanical Station, 148, 359.
Drift-seed from Swansea Bay, 114.
Duroline for Wardian cases, 341.

E.

Early history of Buitenzorg Botanic Gardens, 173.
East Indies, Coffee enterprise in, 123.
Economic plants of Sierra Leone, 167.
Elephant beetle, 44.
Entada scandens, 114.
Erythroxyla Coca, 359.
Eucalyptus marginata, 338.
"Exotic plants from the Royal Gardens, Kew," 147.
Extract of chestnut bark, 229.

F.

Fagopyrum esculentum, 3.
— tataricum, 1.
— — var. himalaica, 1.
Ferns of South Africa, 69.
Fever in cocoa-nut palms, 41.
Fibre extracting machines, 141, 329.
— investigations in the United States, 206.
Fiji fruit trade, 227.
Flora of Mount Kini Balu, 187.
— — St. Vincent and adjacent islets, 231.
Food grains of India, 1.

Fruit growing at the Cape, 8.
— industries of California, 218.
— trade, Fiji, 227.
Fungus Flora, British, 26, 372.
Furcræa gigantea, 321.

G.

Gambia native medicines, 371.
Gambier in British North Borneo, 139.
Gammie, G. A., Botanical exploration of Sikkim-Tibet frontier, 297.
Garbelling of spices, 66.
Garden party at Kew Palace, 190.
Gift of rare and valuable books, 22.
Ginseng, 71.
Gold Coast Botanical Station, 160.
Granger, Mr. W., retirement of, 111.
Grape rust, 68.
Greenheart, 117.
Greenland dried plants, 225.
Grenada Arrowroot, 333.
—, Cacao-growing in, 136.
—, photographs of, 225.
Ground nut in British Honduras, 327.
Guadil, 133.

H.

Hadramaut Valley, expedition to, 366.
Hanbury medallion, 187.
Harrow, Mr. R. L., 65.
Haydon, Mr. W., 340.
Hemileia vastatrix, 321, 362.
Henequen in British Honduras, 328.
— — Yucatan, 212.
Herbarium, additions to, 66, 145, 146, 224, 225, 343, 369.
— and Library, late Keeper of, 188.
Hevea brasiliensis, 159.
Hippeastrum procerum, 186.
Holy wood, 368.
Horticulture in Belgium, 162.
— — Cornwall, 355.
Humphreys, Mr. T., 20.

I.

Iceland dried plants, 225.
Ilex paraguensis, 367.
Index Kewensis, 342.
India, dried plants, 224.
—, strawberries in, 371.
Insect white wax, 84.
Irving, Mr. W., 65.

J.

Japanese dried plants, 146.
Jarrah timber, 338.
Jodrell Laboratory, 188.

K.

Kangra buckwheat, 1.
Karakoram dried plants, 145.
Kew Bulletin, selected papers from, 227.
— Palace, garden party at, 190.
Koleroga, 67.
Krumbiegel, Mr. G. H., 66.

L.

Lagos dried plants, 369.
— plant industries of, 180.
Leitneria floridana, 225.
Liberian coffee, 25.
— — husking, 132.
— — in Sierra Leone, 167.
— — pulping, 204.
Library, additions to, 22, 147, 369.
Life of sisal hemp plants, 319.
Liliaceæ, new, from Tropical Africa, 148.
List of staffs, botanical departments, &c., Appendix III.
— — seeds of hardy herbaceous plants and of trees and shrubs, Appendix I.
Liquorice in the Caucasus, 223.
Lunt, Mr. W., 366.

M.

Maguay fibre, 80.
Malayan dried plants, 145, 369.
Manila aloe fibre, 78.
Margaret Meen's "Exotic Plants from the Royal Gardens, Kew," 147.
Massee, Mr. G., 144.
Mauritius hemp, 321.
Medicines, Gambia native, 371.
Megasoma elephas, 44.
Melhania erythroxylon, 66.
Melon pear, 21.
Mexican dried plants, 224.
Miscellaneous notes, 20, 65, 111, 144, 186, 224, 340, 366.
Mount Kini Balu, flora of, 187.
Mulberries, production of spirits from, 224.
Museæ, Synopsis of, 187.
Museums, additions to, 22, 145, 187, 225, 226.

N.

Nectandra Rodiœi, 117.
New garden plants. Appendix II.
— Liliaceæ from Tropical Africa, 148.
— Orchids, 4, 61, 169, 334.
— World, coffee cultivation in, 321.

O.

Oak of Mamre, 226.
Ocimum basilicum, 371.
Œcodoma cephalotes, 124.
— mexicana, 50.
Oil palm, Sierra Leone, 168.
Oliver, Prof., 188.
Ophiopogon japonicus, 342.
Otto of roses, 22.
Oxytenanthera abyssinica, 341.

P.

Palm weevil, American, 27.
— —, Asiatic, 29.
— — in British Honduras, 27.
Palms, Lagos, 183.
Palo Santo, 368.
Para rubber in Ceylon, 159.
Parasol ant, 50, 124.
Pellicularia Koleroga, 67.
Pepino, 21.
Pepper cultivation, 370.
— in Siam, 230.
Persian dried plants, 145.
Peruvian colonisation, 350.
Photographs of tropical scenery, 225.
Phylloxera in Uruguay, 372.
Pimento in British Honduras, 329.
Pine apple fibre, 368.
— — — in United States, 208.
— —, Sierra Leone, 169.
— products of British Honduras, 328.
Pita, Bahamas, 320.
—, Turks Island, 227.
Plant industries of Lagos, 180.
— — in the Caucasus, 223.
Plants and excess of moisture, 189.
— from the Shiré Highlands, 112.
Plasmodiophora, 228.
Poling in Agave plants, 315.
Prieto fibre extracting machine, 329.
Principal Assistant (Cryptogams), 144.
Prune cultivation in California, 175.
Pulping Liberian coffee, 204.

Q.

Queensland, abolition of post of Colonial Botanist, 366.
— arrowroot, 331.

R.

Redwood of St. Helena, 66.
Resources of British Honduras, 326.
Rhina barbirostris, 44.
— nigra, 45.
Rhus cotinoides, 340.
Rhynchophorus cruentatus, 29.
— ferrugineus, 29.
— palmarum, 27.

Robinia hispida in fruit, 341.
Rood snot, 348.
Root disease of sugar-cane, 345.
Rosa spp., 22.
Rose-growing and pressing in Saxony, 229.
Roses, attar of, 22.
Rosewoods, Canary, 133.
Royal Scottish Arboricultural Society, 340.
Rubber in Sierra Leone, 167.
—, Lagos, 183.
—, Para, in Ceylon, 159.

S.

Sacqui, 320.
St. Helena, redwood of, 66.
St. Vincent and adjacent islets, Flora of, 231.
— — arrowroot, 191.
Sansevieria Kirkii, 186.
Sapodilla in British Honduras, 329.
Saxony, rose-growing and pressing in, 229.
Sclerocarya sp., 371.
Scott, Mr. W., 340.
Selected papers from the Kew Bulletin, 227.
Senecio sagittifolius, 111.
Shantung cabbage, 344.
Shiré Highlands plants, 112, 341.
Siam, pepper in, 230.
Sierra Leone, economic plants of, 167.
Sikkim-Tibet frontier, botanical exploration of, 297.
Sisal hemp in Turks Island, 227.
— — in United States, 206.
— —, life of plants, 319.
Smyrna dried plants, 369.
Solanum guatemalense, 21.
— muricatum, 21.
SouthAfrica, dried plants, 146,369.
— — ferns, 69.
Sphæranthus hirtus, 371.
Spices, garbelling of, 66.
Spirits from mulberries, 224.
Stapelias, 186.
Strawberries in India, 371.
Strophanthus Kombé, 183.
Sugar-cane disease, 149, 345.
Synopsis of the Museæ, 187.

T.

Tagasaste, 115.
Technical education in West Africa, 364.
Text book of tropical agriculture, 69.
Theo-metl, 80.
Tibet, dried plants, 369.
Timber trees, Lagos, 183.
Tonquin Y-dzi, 76.
Trichosphæria, 149.
Tropical Africa, dried plants, 146.
— — new Liliaceæ from, 148.
— agriculture, text book of, 69.
Turks Island, Sisal in, 227.

U.

Uncaria Gambier, 359.
United States, fibre investigations in, 206.
Uredo Vialæ, 68.
— vitis, 69.
Uruguay, viticulture in, 371.

V.

Vanilla in British Honduras, 327.
Vegetable fibres, 227.
Velloziеæ, 20.
Vine diseases, 227, 228, 372.
Visitors to Royal Gardens, 67.
Viticulture in Uruguay, 371.

W.

Ward, Mr. J. R., 366.
Wattle bark, 370.
Wax, Chinese white, 84.
Weicher's fibre extracting machine, 141.

West Africa, beefwood trees, 25.
— African botanic stations, 363.
White wax, Chinese, 84.
Willey, Mr. F. E., 66.
Wine industry in the Caucasus, 223.
Wittsteinia vaccineacea, 112.
Wood of Araucaria, 225.
Wormwood as a fodder plant, 126.

Y.

Yaxci, 320.
Y-dzi of Tonquin, 76.
Yucatan, Henequen hemp in, 212.

Z.

Zanzibar, clove industry of, 17.
Zimmer, Mr. C. W., 340.